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The College of Arts and Sciences

Announcement of the Department of Chemistry

1925-26

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DEPARTMENT OF CHEMISTRY: LECTURE SCHEDULE

FIRST TERM

Hour	MON.	TUE.	WED.	THUR.	FRI.	SAT.	*Hour*
8	775	505	775	505			8
9	205 245 305 405	220 315 630	205 305 405	220 315 630	305 405 525		9
10	705	430	705	430	705		10
11	101[1] 130 250 725	101[2] 415 460 605 805	101[1] 130 250 725	101[2] 415 460 605 805	101[1] 130 325	101[2]	11
12	255 375 450 530	210 535	255 375 450	255 520	375	375	12

SECOND TERM

Hour	MON.	TUE.	WED.	THUR.	FRI.	SAT.	*Hour*
8	775	505	775	505			8
9	205 305 405	140 220 315 640	205 305 405 542	140 220 315 640	305 405 542		9
10	530 705	430 776	705 880	430 776	705 880		10
11	101[1] 130 250 720	101[2] 415 460 615 815	101[1] 130 250 720	101[2] 415 460 615 815	101[1] 130 335 715	101[2]	11
12	235 450 875	210 550	235 450 875	225 520	 875		12

THE DEPARTMENT OF CHEMISTRY

STAFF OF INSTRUCTION

Louis Munroe Dennis, D.Sc., Professor of Inorganic Chemistry.
William Ridgely Orndorff, Ph.D., Professor of Organic Chemistry.
Wilder Dwight Bancroft, Ph.D., D.Sc., Professor of Physical Chemistry.
George Walter Cavanaugh, B.S., Professor of Agricultural Chemistry.
Emile Monnin Chamot, Ph.D., Professor of Chemical Microscopy and Sanitary Chemistry.
Arthur Wesley Browne, Ph.D., Professor of Inorganic Chemistry.
Fred Hoffman Rhodes, Ph.D., Professor of Industrial Chemistry.
Thomas Roland Briggs, Ph.D., Professor of Physical Chemistry.
Melvin L. Nichols, Ph.D., Assistant Professor of Analytical Chemistry.
Jacob Papish, Ph.D., Assistant Professor of Chemical Spectroscopy.
Frederick Raymond Georgia, Ph.D., Instructor in Sanitary Chemistry.
Asa Emanuel McKinney, Ph.D., Instructor in Inorganic Chemistry.
Ralph T. K. Cornwell, Ph.D., Instructor in Organic Chemistry.
George Henry Brandes, Ph.D., Instructor in Analytical Chemistry.
Clyde Walter Mason, Ph.D., Instructor in Chemical Microscopy.
Edgar Blauvelt Johnson, Ph.D., Instructor in Industrial Chemistry.
Charles Walter Morse, B.Chem., Instructor in Analytical Chemistry.
Robert Brainard Corey, Ph.D., Instructor in Analytical Chemistry.
Jack Miscall, M.S., Instructor in Agricultural Chemistry.

ASSISTANTS IN CHEMISTRY

Raymond Peck Allen, A.B.
Ludwig Frederick Audrieth, B.S.
Nicholas Bacon, M.S.
George Monroe Bateman, B.S.
Irving Tracy Beach, B.Chem.
Seymour Wilson Brainard, B.S.
Milton Lester Byron, B.Chem.
Peter Panagiotes Carodemos, B.S.
Neil Roswell Currie, A.B.
John Sutliff Fonda, B.Chem.
James William Fraze, M.A.
Harold Ellsworth Goldsmith, B. Chem.
Abel Charles Gurchot, B.Chem.
Danforth Rawson Hale, A.B.
Romulus Seitz von Hazmburg, B. Chem.
Donald Aubrey Holt, B.Chem.
Robert Charles Houck, B.Chem.
Edward Wesley Hughes, B.Chem.
Howard Louis Hunter, B.Chem.
Charles Henry Johnson, M.A.
Ernest Jacob Joss, M.A.
John Calvin Keller, B.S.
Lawrence Gane Knowlton, A.B.
Harold Talbot Lacey, B.Chem.
Leo Joseph Larkin, A.B.
Louis Leonard Larson, B.S.
Albert Washington Laubengayer, B.Chem.
Harold Adlard Lovenberg
David Wilson Moore, 3rd., B.Chem.
Felix Edward Reifschneider, B. Chem.
Harris White Rogers, M.S.
Charles Blackmer Rutenber, B. Chem.
Charles Hamilton Saylor, B.Chem.
Charles William Stillwell, B.Chem.
Fenton Hendy Swezey, B.Chem.
Carl William Tucker, M.S.
Harry Morton Vars, A.B.
George Paul Vincent, M.S.
John Davis Dabney Ware, A.B.
Christopher John Welz, M.S.
Laverne Harold Willisford, B.S.
Charles Oliver Willits, B.S.

FELLOWS AND SCHOLARS IN CHEMISTRY

1924–25

The Sage Fellowship: LAUCHLIN MACLAURIN CURRIE, M.A.
The Grasselli Fellowship: NATHANIEL FUCHS, B.Chem.
The Du Pont Fellowship: PAUL WARTTMAN, M.S.
The Palm Olive Fellowship: PAUL HENRY FALL, M.A.
The National Canners Fellowship: LAWRENCE FRANCIS PRATT, B.S.
Graduate Scholarship: JEANETTE LUKENS KERBAUGH, B.S.
The Grasselli Undergraduate Scholarship: CARLISLE SCHADE.

COLLEGE OF ARTS AND SCIENCES

THE COURSE IN CHEMISTRY

The College of Arts and Sciences offers a four-year course leading to the degree of Bachelor of Chemistry. This course is designed primarily to prepare the student for the profession of chemistry, either in the field of teaching or in the chemical industries. It includes adequate instruction in allied subjects, such as Mathematics, Physics, and Engineering, that are usually comprised in courses elsewhere designated "Chemical Engineering." It moreover includes extended instruction not only in the fundamental divisions of chemical science, but also in numerous special branches designed to acquaint the student with the best modern methods of attacking the many varied problems that may arise in the future practice of his profession.

The requirements in effect until September 1925 for entrance to the course leading to the degree of Bachelor of Chemistry, together with information concerning tuition, fees, living expenses, scholarships, prizes, financial assistance, and opportunities for self-support, will be found in the General Circular of Information, which may be obtained from the Secretary of the University.

After September 1925 candidates for admission to the course leading to the degree of Bachelor of Chemistry will be required to offer the following units at entrance: English, 3; French 3 or German 3, or French 2 *and* German 2; History, 1; Plane Geometry, 1; Elementary Algebra, 1; Intermediate Algebra, ½; Solid Geometry, ½; Advanced Algebra, ½; Plane Trigonometry, ½; Elective 3 or 4; total 15 units. After the date mentioned above the entrance requirements for the degree of Bachelor of Arts will no longer be accepted for the Course in Chemistry.

THE DEGREE OF BACHELOR OF CHEMISTRY

The degree of Bachelor of Chemistry will be awarded to those who have satisfactorily completed the following curriculum and the requirements prescribed by the University in Hygiene and Preventive Medicine and in Military Drill or in Physical Training.

Students who do not present, on entrance, at least two units of French and two units of German, will be required to make up the

shortage before the beginning of the junior year. This may not be done, except with special permission of the Department, by taking University courses in French or German during the academic year.

THE CURRICULUM

First Year

	Course	First Term	Second Term
Introductory Inorganic Chemistry	Chemistry 101	6	—
Introductory Qualitative Analysis	Chemistry 205	—	6
Analytic Geometry and Calculus	Mathematics 5a, 7	5	5
Introductory Experimental Physics	Physics 5	—	5
Drawing	Engineering 125	3	—
English	English 1	3	3

Second Year

Introductory Organic Chemistry	Chemistry 305	3	3
Organic Chemistry Laboratory	Chemistry 310	3	3
Introductory Quantitative Analysis	Chemistry 220	6	—
Introductory Chemical Spectroscopy	Chemistry 505	—	3
Gas and Fuel Analysis	Chemistry 250	4 or 0	0 or 4
Elementary Mineralogy	Geology 11	0 or 3	3 or 0
Heat and Light	Physics 31	2	—
Magnetism and Electricity	Physics 32	—	2
Physical Experiments	Physics 14	—	2

Third Year

Introductory Physical Chemistry	Chemistry 405	3	3
Physical Chemistry Laboratory	Chemistry 410	3	3
Advanced Inorganic Chemistry	Chemistry 130	3	3
Introductory Chemical Microscopy	Chemistry 530	3	—
Quantitative Analysis, Lectures	Chemistry 235	—	2
Advanced Quantitative Analysis	Chemistry 230	—	4
Physical Experiments	Physics 14	2	—
Elective	(at least)	4	4

Fourth Year

Introductory Industrial Chemistry	Chemistry 705	3	3
Seminary	Chemistry 905	—	1
Research for Seniors	Chemistry	4	4
Mechanical Laboratory	Engineering 367	—	4
Electrical Engineering	Engineering 417	4	—
Elective	(at least)	6	6

Candidates for the degree of Bachelor of Chemistry are required to take at least eight hours in research during the senior year in a division of the Department to be selected by the student. These divisions are: Inorganic Chemistry (Course 195); Analytical Chemistry (Course 295); Organic Chemistry (Course 395); Physical Chemistry (Course 495); Optical Chemistry (Course 595); Sanitary Chemistry (Course 695); Industrial Chemistry (Course 795); Agricultural Chemistry (Course 895).

The elective courses required in the curriculum may be chosen by the student, in each case with the approval of the Department of Chemistry, from the advanced courses in Chemistry, or from certain courses in other departments of the College of Arts and Sciences, or in other colleges of the University.

Students in the Course in Chemistry may register for 20 hours a term. To register for more than 20 hours, the student must first secure the consent of the Department.

The Honor Code in Examinations

Under a constitution proposed and adopted by the students, and approved by the University Faculty on March 9, 1921, all students of Cornell University are put upon their honor with respect to their conduct in examinations and in other tests of work by which they are earning academic credit. The students have made themselves responsible for maintaining the code. For the trial of charges of breach of honor they elect committees of their own—a central committee for the University, and a committee in each of the colleges. Every student is expected to do his share in upholding the code, not only by honorable conduct on his own part, but also by refusal to conceal or condone fraud on another's part. A fraud observed in any college should be reported to a member of the student honor Committee of that college.

COURSES OF INSTRUCTION

All courses listed below are to be given in the Baker Laboratory of Chemistry.

Those courses which are marked with the asterisk (*) may not be counted for upperclass group by candidates for the degree of Bachelor of Arts.

INORGANIC CHEMISTRY

*101. **Introductory Inorganic Chemistry.** Lectures, recitations, and laboratory practice. Repeated in the second term. Credit six hours. May not be counted for upperclass group by candidates for the degree of Bachelor of Arts.

Lectures. *Main Lecture Room.* Two sections: M W F 11; T Th S 11. Professors Dennis and Browne, and Dr. McKinney.

Recitations, one hour a week, to be arranged.

Laboratory sections: M F 2–4:30; T Th 2–4:30; W 2–4:30, S 8–10:30. *Room* 150. Professors Dennis and Browne, Dr. McKinney, and assistants.

Entrance credit in chemistry does not carry with it University credit in course 101. If a student entering the University from a preparatory school desires credit in course 101 he must pass an examination set by the Department of Chemistry. This examination is held in New York City and in Ithaca on the same day in September as the entrance examination. University credit in course 101 that is obtained by passing this examination does not carry with it entrance credit in chemistry.

Examinations for those who were unavoidably absent from the final examination in course 101 will be held at 2 p. m. on the day before instruction begins in the fall.

130. **Advanced Inorganic Chemistry.** Lectures. Throughout the year. Credit three hours a term. Open to those who have completed or are taking courses 405 and 410. M W F 11. *Room* 107. Professors Dennis and Browne.

Discussion of the chemical elements in the order in which they occur in the Periodic Table of Mendelèeff, with special attention to the group properties of the elements and to the relations of the groups to one another. The rare elements and the rare earths are treated in as great detail as are the more common elements.

135. **Advanced Inorganic Chemistry.** Laboratory practice. Either term. Credit one to six hours. Prerequisite courses 305 and 310. Hours to be arranged. *Rooms* 178 and 122. Professors Dennis and Browne, and assistants.

The study of the preparation, purification, properties, and reactions of inorganic compounds, including those of the rarer elements.

Course 135 is designed to accompany course 130, but either course may be taken separately.

[140. **Selected Topics in Advanced Inorganic Chemistry.** Lectures. Second term. Credit two hours. Open to those who have completed or are taking courses 405 and 410. T Th 9. *Room* 107. Professor BROWNE. Not given in 1925–26.]

195. **Research for Seniors.** Throughout the year. See page 5. Professors DENNIS and BROWNE, and Dr. MCKINNEY.

ANALYTICAL CHEMISTRY

205. **Introductory Qualitative Analysis.** Lectures, recitations, and laboratory practice. Repeated in the second term. Credit six hours. Prerequisite course 101.

Lectures, M W 9. *Room* 107. Assistant Professor NICHOLS.

Recitations, one hour a week, to be arranged.

Laboratory section: M W F 2–4:30. *Room* 50. Assistant Professor NICHOLS, Dr. COREY, and assistants.

The properties and reactions of the common elements, and of the common inorganic and organic acids; the qualitative analysis of a number of solutions and solid compounds.

Students in science are advised, and candidates for the degree of Bachelor of Chemistry are required, to take this course instead of course 210.

*210. **Introductory Qualitative Analysis.** Shorter course. Lectures and laboratory practice. Repeated in the second term. Credit three hours. May not be counted for upperclass group by candidates for the degree of Bachelor of Arts. Prerequisite course 101.

Lecture, T 12. *Room* 207. Dr. COREY.

Laboratory sections: T Th 8–10:30; T Th 2–4:30. *Room* 50. Dr. COREY and assistants.

The properties and reactions of the common elements and acids, and their detection in various liquid and solid mixtures.

215. **Advanced Qualitative Analysis.** Laboratory practice. Second term. Credit one, two, or three hours. Prerequisite courses 220, 305, and 310. Hours to be arranged. *Room* 50. Assistant Professor NICHOLS, Dr. COREY, and assistants.

Essentially a continuation of course 205. A study of the methods for separating and detecting a number of metals and acids not studied in course 205, including many of the rare elements. The qualitative analysis of a number of solutions, solid mixtures, natural and commercial products will be required. For graduates and advanced undergraduates.

220. **Introductory Quantitative Analysis.** Lectures, recitations, and laboratory practice. Repeated in the second term. Credit six hours. Prerequisite course 205.

Lectures, T Th 9. *Room* 207. Assistant Professor NICHOLS.

Recitations, one hour a week, to be arranged.

Laboratory sections: first term, M T W 2–5; T Th 10–1, S 9–12; second term, W Th F 2–5; T Th 10–1, S 9–12. *Room* 252. Assistant Professor NICHOLS, Dr. BRANDES, and assistants.

The preparation and standardization of various volumetric solutions and their use in analyzing a variety of substances; gravimetric methods; stoichiometry.

Students in science are advised, and candidates for the degree of Bachelor of Chemistry are required, to take this course instead of course 225.

*225. **Introductory Quantitative Analysis.** Shorter course. Lectures and laboratory practice. Repeated in the second term. Credit three hours. May not be counted for upperclass group by candidates for the degree of Bachelor of Arts. Open to those who have completed or are taking course 210.

Lecture, Th 12. *Room* 207. Dr. BRANDES.

Laboratory sections: first term, Th F 2–5; T Th 9–12; second term, M T 2–5; T Th 9–12; Th F 2–5. *Room* 252. Dr. BRANDES and assistants.

230. **Advanced Quantitative Analysis.** Recitations and laboratory practice. Repeated in the second term. Credit four hours. Prerequisite course 220.

Recitation, one hour a week, to be arranged.

Laboratory periods: first term, M T W 2–5:30, T Th 9–1, S 8–1; second term, M T W Th F 2–5:30, T Th S 8–1. *Rooms* 277 and 294. Students will be assigned to a combination of laboratory periods that will total ten hours a week. Assistant Professor NICHOLS, Dr. BRANDES, and assistants.

Gravimetric, volumetric, and electrolytic methods of analysis, and methods of combustion analysis; the calibration of weights and volumetric apparatus, analysis of iron and steel, alloys, silicates, etc.

235. **Advanced Quantitative Analysis.** Lectures. Second term. Credit two hours. Prerequisite, first term of course 405. M W 12. *Room* 207. Assistant Professor NICHOLS.

Selected topics in advanced quantitative analysis; stoichiometry.

240. **Electrochemical Analysis.** Laboratory practice. Repeated in the second term. Credit one or two hours. Prerequisite courses 230 and 405. Hours to be arranged. *Room* 292. Assistant Professor NICHOLS and Dr. BRANDES.

A study of the most approved electrochemical methods for the determination of silver, lead, copper, tin, nickel, cobalt, and zinc. Practice will be given in the analysis of alloys and ores.

245. **Assaying.** Lectures and laboratory practice. First term. Credit two hours. Prerequisite, course 225 (or 220), and if possible a course in mineralogy.

Lecture, M 9. *Room* 202. Dr. BRANDES.

Laboratory sections: M 2–4:30; W 2–4:30. *Rooms* B-91 and B-96. Dr. BRANDES and assistant.

Lectures on the theory and practice of scorification and crucible assay, and on the metallurgy of copper, lead, zinc, silver, and gold. In the laboratory, practice is given in the assay of zinc, lead, copper, gold, and silver ores, mattes, and bullion. Designed for students in Chemistry and Geology, and as an elective in Mechanical and Civil Engineering.

250. **Gas and Fuel Analysis.** Lectures and laboratory practice. Repeated in the second term. Credit four hours. Prerequisite Physics 5. Open to those who have completed or are taking course 220.

Lectures, M W 11. *Room* 207. Mr. MORSE.

Laboratory sections: M T 2–4:30; W Th 2–4:30; T Th 10–12:30; S 8–1. *Room* 282. Mr. MORSE and assistants.

The complete analysis of coal gas, flue gas, and air; the determination of the heating power of gaseous, liquid, and solid fuels; the analysis of coal; standard methods of testing various petroleum and coal-tar products; the analysis of various substances by methods involving the use of different types of gas evolution apparatus. Problems are assigned which afford practice in the calculation and interpretation of results.

255. **Advanced Gas Analysis.** Lectures. First term. Credit two hours. Prerequisite course 250. M W 12. *Room* 207. Assistant Professor NICHOLS.

A presentation of important methods and a discussion of special forms of apparatus used in scientific gas analysis.

260. **Advanced Gas Analysis.** Laboratory practice. Either term. Credit two hours. Prerequisite course 250. Hours to be arranged. *Room* 282. Assistant Professor NICHOLS, Mr. MORSE, and assistants.

The use of special forms of apparatus and practice in the design and construction of apparatus for scientific investigation in this field.

Course 260 is designed to accompany course 255, but either course may be taken separately.

270. **Special Methods of Quantitative Analysis.** Laboratory practice. Either term. Credit two, three, or four hours. Prerequisite courses 230 and 235. Hours to be arranged. *Room* 277. Assistant Professor NICHOLS and assistants.

Practice in the application of special methods such as indirect analysis, conductivity, electrometric titrations, etc., to quantitative analysis, and the analysis of special steels, ores, slags, alloys, etc.

Within certain limits the work may be selected to suit the requirements of the individual student.

295. **Research for Seniors.** Throughout the year. See page 5. Assistant Professor NICHOLS, Dr. COREY, and Dr. BRANDES.

ORGANIC CHEMISTRY

305. **Introductory Organic Chemistry.** Lectures and written reviews. Throughout the year. Credit three hours a term. Prerequisite courses 210 and 225 (or 205 and 220). Open to those who are taking course 220. M W 9. *Room* 207. F 9. *Main Lecture Room.* Professor ORNDORFF and Dr. CORNWELL.

The lectures discuss systematically the more important compounds of carbon, their occurrence, methods of preparation, relations, and uses and are illustrated by experiments and material from the museum.

310. **Introductory Organic Chemistry.** Laboratory practice and oral reviews. Throughout the year. Credit three hours a term. Open to those who have completed or are taking course 305. Laboratory sections: M T 2–5:45; F 2–5:45, S 8–11:45. *Room* 250. Professor ORNDORFF, Dr. CORNWELL, and assistants.

The student prepares a large number of typical compounds of carbon and familiarizes himself with their properties, reactions, and relations. The detection of inorganic elements in organic compounds and the recognition of various groups of radicals, with the identification of unknown compounds, is included in the laboratory work.

315. **Advanced Organic Chemistry.** Lectures. Throughout the year. Credit two hours a term. Prerequisite courses 305 and 310. T Th 9. *Room* 206. Professor ORNDORFF and Dr. CORNWELL.

A presentation of important chapters of organic chemistry and a discussion of classical researches in this field.

320. **Advanced Organic Chemistry.** Laboratory practice. Either term. Credit two to six hours a term. Open to those who have completed or are taking course 315. Hours to be arranged. *Room* 208. Professor ORNDORFF, Dr. CORNWELL, and assistants.

An advanced course in the preparation of organic compounds. The original literature is consulted, and before taking up original work in this field, the student is required to repeat some extended and important piece of work, and to compare his results with those published.

[325. **The Coal Tar Dyestuffs.** Lectures. First term. Credit one hour. Open to those who have completed or are taking course 315. F 11. *Room* 206. Professor ORNDORFF.

Discussion of methods of manufacture of intermediates and dyestuffs and of their properties, constitution, and relationships. The treatment is scientific rather than technical. Not given in 1925–26.]

330. **The Coal Tar Dyestuffs.** Laboratory practice. Either term. Credit two to four hours a term. Open to those who have completed or are taking course 325. Hours to be arranged. *Room* 208. Professor ORNDORFF and Dr. CORNWELL.

Preparation of various intermediate products used in the manufacture of dyes, and of representatives of the different groups of dyestuffs.

335. **Stereochemistry.** Lectures. Second term. Credit one hour. Prerequisite course 305. F 11. *Room* 206. Professor ORNDORFF.

The stereochemistry of the compounds of carbon and nitrogen. The necessity of considering the space relations of the atoms in certain classes of isomers is shown and the close agreement of facts and theory is brought out.

340. **Methods of Organic Analysis.** Laboratory practice. Either term. Credit two to six hours a term. Prerequisite courses 305 and 310. Hours to be arranged. *Room* 208. Professor ORNDORFF and Dr. CORNWELL.

Practice in the qualitative and quantitative analysis of commercial organic products such as alcohols, ethers, organic acids, glycerin, formalin, acetates, coal tar distillates, petroleum products, soaps, acetanilide, etc.

375. **Elementary Organic Chemistry.** Lectures, written reviews, and laboratory practice. First term. Credit, lectures and written reviews only, four hours; with laboratory, five to six hours. Students who are preparing for the study of medicine must take the whole six hours. Prerequisite courses 210 and 225 (or 205 and 220). Open to those who are taking course 220.

Lectures and written reviews, M W F S 12. *Main Lecture Room.* Dr. CORNWELL.

Laboratory section and oral reviews. M W 2–4:30. *Room* 250. Dr. CORNWELL and assistants.

395. **Research for Seniors.** Throughout the year. See page 5. Professor ORNDORFF and Dr. CORNWELL.

PHYSICAL CHEMISTRY

405. **Introductory Physical Chemistry.** Lectures. Throughout the year. Credit three hours a term. Prerequisite course 305 (or 375) and Physics 5 and 31. M W F 9. *Room* 7. Professor BRIGGS.

A systematic presentation of modern chemical theory in which special attention is paid to the following topics: Gases, liquids, and solids; the theory of solution; reaction velocity, catalysis, and chemical equilibrium; the Phase Rule; colloid chemistry; thermochemistry; and elementary electrochemistry. Problems in physical chemistry.

It is advisable, but not obligatory, that course 410 accompany this course.

410. **Introductory Physical Chemistry.** Laboratory practice. Throughout the year. Credit three hours a term. Open to those who have completed or are taking course 405. Laboratory sections: M T 2–4:30; S 8–1. *Room* 1. Professor BRIGGS and assistants.

Qualitative and quantitative experiments illustrating the principles of physical chemistry and including practice in performing physical chemical measurements. An important feature of this course is the presentation of detailed reports based upon data obtained in the laboratory.

[415. **Advanced Physical Chemistry.** Lectures. Throughout the year. Credit two hours a term. Prerequisite course 405. T Th 11. *Room* 7. Professor BANCROFT.

An exposition of the law of mass action in its application to chemical equilibrium and reaction velocities. Not given in 1925–26.]

430. **Applied Colloid Chemistry.** Lectures. Throughout the year. Credit two hours a term. Open to candidates for the degree of Bachelor of Chemistry if they have completed course 405; to others only by special permission. T Th 10. *Room* 7. Professor BANCROFT.

The theory of colloid chemistry and its application in the arts.

450. **Applied Electrochemistry.** Lectures. Throughout the year. Credit two hours a term. Prerequisite course 405. M W 12. *Room* 7. Professor BRIGGS.

The theory of electrolysis and electromotive force; electrolytic extraction and refining of metals; electrolytic manufacture of organic and inorganic compounds; theory and practice of storage cells; preparation of compounds in the electric furnace. Problems in electrochemistry.

455. **Applied Electrochemistry.** Laboratory practice. Throughout the year. Credit two hours a term. Open to those who have completed or are taking course 450. Hours to be arranged. *Room* 1-A. Professor BRIGGS and assistant.

Qualitative and quantitative study of electrolysis; determination of electrical conductivity; potentiometric measurements; hydrogen ion concentration; determination of current and energy efficiencies in electrolytic and electrothermal work; electrolytic preparation of organic and inorganic compounds; tests of storage cells; preparation of compounds in the electric furnace; measurement of furnace temperatures.

460. **Theoretical Electrochemistry.** Lectures. Throughout the year. Credit two hours a term. Prerequisite course 405. T Th 11. *Room* 7. Professor BANCROFT.

The historical development of the subject with special reference to the theory of the voltaic cell. For advanced students in Chemistry or Physics.

465. **Advanced Physical Chemistry.** Laboratory practice. Either term. Credit not to exceed six hours a term. Prerequisite courses determined in each case by the professor in charge. Hours and work to be arranged. *Room* 94. Professors BANCROFT and BRIGGS, and assistants.

Students may elect in mass law, reaction velocity, or efficiency measurements with special reference to course 415; in photo-chemistry, photography, or colloid

chemistry with special reference to course 430; in conductivity, or electrometric determinations with special reference to course 460; in electrolytic, or electric furnace products with special reference to course 450; in the application of physical chemical methods to organic chemistry.

495. **Research for Seniors.** Throughout the year. See page 5. Professors BANCROFT and BRIGGS.

OPTICAL CHEMISTRY

505. **Introductory Chemical Spectroscopy.** Lectures, written reviews, and laboratory practice. Repeated in the second term. Credit three hours. Prerequisite courses 210 and 225 (or 205 and 220). Open to those who have completed or are taking Physics 31.

Lectures and written reviews, T Th 8. *Room* 377. Assistant Professor PAPISH.

Laboratory sections: M T W Th F 2–4:30, S 8–10:30. *Rooms* 392 and 396. Assistant Professor PAPISH and assistants.

The construction and the use in chemical analysis of the spectroscope, polariscope, refractometer, colorimeter, and nephelometer. The laboratory instruction is devoted to the training of the student in the use of these instruments in the solving of chemical problems.

510. **Advanced Chemical Spectroscopy.** Laboratory practice. Either term. Credit two or more hours. Prerequisite course 505. Hours to be arranged. *Room* 396. Assistant Professor PAPISH and assistants.

The study of arc, spark, and absorption spectra and the application of spectroscopic methods to the identification of dyestuffs. Practice in one or more of the subjects mentioned may be selected by the student.

520. **Spectrographic Methods.** Laboratory practice. Either term. Credit one or more hours. Prerequisite course 505. Hours to be arranged. *Room* 396. Conference, Th 12. *Room* 377. Assistant Professor PAPISH.

The application of photographic methods to arc, spark, and absorption spectroscopy. Practice is also given in the application of ultra-violet spectroscopy in chemical analysis.

525. **Special Methods in Optical Chemistry.** Lectures, demonstrations, and laboratory practice. First term. Credit two hours. Prerequisite course 505.

Lecture, F 9. *Room* 377. Assistant Professor PAPISH.

Laboratory. Hours to be arranged. *Room* 392. Assistant Professor PAPISH.

A study of special optical instruments as applied to the solution of problems arising in the chemical industries and in research. Modifications of commonly employed polarimeters, refractometers, nephelometers, colorimeters, etc., as employed in specific industries.

530. **Introductory Chemical Microscopy.** Lectures and laboratory practice. Repeated in the second term. Credit three hours. Prerequisite courses 210 and 225 (or 205 and 220), and Physics 31.

Lecture, first term, M 12; second term, M 10. *Room* 377. Professor CHAMOT and Dr. MASON.

Laboratory sections: M T 2–4:30; T Th 10–12:30; Th F 2–4:30. *Room* 378. Professor CHAMOT, Dr. MASON, and assistants.

The use of the microscope and its accessories; microscopic methods as applied to chemical investigations; micrometry; the examination of crystalline compounds; recognition of textile and paper fibers, etc. The application of microscopic methods to quantitative analysis.

535. **Advanced Chemical Microscopy.** Laboratory practice. Repeated in the second term. Credit three or more hours. Prerequisite course 530. Laboratory periods: M T Th F 2–5; T Th 10–1. *Room* 378. Conference, T 12. *Room* 377. Professor CHAMOT, Dr. MASON, and assistants.

Practice in the examination and analysis of inorganic substances containing the more common elements with special reference to rapid qualitative methods and to the analysis of minute amounts of material.

540. **Advanced Chemical Microscopy.** Laboratory practice. Second term. Credit two hours. Prerequisite course 530. Hours to be arranged. *Room* 378. Professor CHAMOT, Dr. MASON, and assistants.

Organic qualitative microscopic analysis as applied to the detection of common commercial organic compounds, vegetable alkaloids, "strong drugs," etc., with particular emphasis upon the analysis of minute quantities of material.

In this course work may be elected in the microscopy of textile or paper fibers.

542. **Special Methods in Chemical Microscopy.** Lectures and demonstrations. Second term. Credit two hours. Prerequisite course 530. W F 9. *Room* 377. Professor CHAMOT and Dr. MASON.

A discussion of microscopic methods as applied to the solution of industrial and research problems. Microscopes of special and unusual construction, such as ultramicroscopes, supermicroscopes, luminescence microscopes, long distance microscopes, etc.; their uses and their limitations.

545. **Microscopy of Commercial Alloys.** Laboratory practice. Second term. Credit two hours. Prerequisite course 530. *Room* 384. Hours to be arranged. Professor CHAMOT, Dr. MASON, and assistants.

An introduction to the methods employed in the microscopic examination of metals, alloys, and other metallurgical products; practice in grinding, polishing, and etching specimens for microscopic study; metallographic microscopes and their use.

This course may be extended to include other materials of construction.

550. **Microscopy of Foods and Beverages.** Laboratory practice. First term. Credit two hours. Prerequisite course 530. Hours to be arranged. *Room* 378. Conference, Th 12. *Room* 377. Professor CHAMOT, Dr. MASON, and assistants.

The application of microscopic methods to the examination of foods and beverages for the purpose of ascertaining their purity and for the detection of deteriorations, adulterations, and admixtures.

555. **Introductory Photomicrography.** Laboratory practice. Second term. Credit two or more hours. Prerequisite course 530. Hours to be arranged. *Room* 382. Professor CHAMOT and Dr. MASON.

595. **Research for Seniors.** Throughout the year. See page 5. Professor CHAMOT, Assistant Professor PAPISH, and Dr. MASON.

SANITARY CHEMISTRY

605. **Introductory Sanitary Chemistry (Foods).** Lectures. First term. Credit two hours. Prerequisite course 305 (or 375). T Th 11. *Room* 377. Dr. GEORGIA.

Chemistry of foods, beverages, and food accessories; special apparatus; adulteration and misbranding, sweeteners, preservatives, food colors, food poisonings, and methods for their detection. Relation of the chemical composition of materials used in the household to the public health. Garbage disposal.

It is advisable, but not obligatory, that course 610 accompany this course.

610. **Introductory Sanitary Chemistry (Foods).** Laboratory practice. First term. Credit two hours. Open to those who have completed or are taking course 605. Laboratory sections: M T 2–4:30; S 8–1. *Room* 352. Dr. GEORGIA and assistant.

Laboratory exercises designed to illustrate the material presented in course 605. General and special methods of analysis of foods, beverages, and food accessories with special reference to the detection of adulteration. The use of saccharimeters, refractometers, cryoscopes, muffle furnaces, vacuum ovens, etc.

615. **Introductory Sanitary Chemistry (Water).** Lectures. Second term. Credit two hours. Prerequisite course 305 (or 375). T Th 11. *Room* 377. Dr. GEORGIA.

Pollution of water; physical, chemical, bacteriological, and microscopical examination of water for household and municipal purposes; examination of sewage and sewage effluents; introduction to the methods of water purification, water softening, and sewage disposal, and their control. Interpretation of analytical results and the preparation of sanitary surveys.

It is advisable, but not obligatory, that course 620 accompany this course.

620. **Introductory Sanitary Chemistry (Water).** Laboratory practice. Second term. Credit two hours. Open to those who have completed or are taking course 615. Laboratory sections: M T 2–4:30; S 8–1. *Room* 352. Dr. GEORGIA and assistant.

Laboratory exercises designed to illustrate the material presented in course 615.

630. **Advanced Sanitary Chemistry (Water).** Lectures and conferences. First term. Credit two hours. Prerequisite course 615. T Th 9. *Room* 377. Dr. GEORGIA.

Sources of water; methods of water purification, sedimentation, filtration, disinfection; control of water purification; tastes and odors and their control; boiler waters and water softening; iron removal; deactivation of waters; methods of sewage disposal and control.

Laboratory practice to accompany this course may be elected under course 635.

635. **Advanced Sanitary Chemistry.** Laboratory practice. Either term. Credit two or more hours. Prerequisites to be determined in each case by the instructor in charge. Hours to be arranged. *Rooms* 352, 356, 358. Dr. GEORGIA and assistant.

Students who have had adequate preparation may elect work in any branch of sanitary chemistry. Among others, work along the following lines may be taken:

The bacteriology of water.
Continuation of work offered in courses 610 or 620.
The control of water purification.
Water softening.
Disinfectants, etc.

The work in many cases may be arranged to meet the needs of the individual student.

640. **Sanitary Chemistry (Disinfectants).** Lectures. Second term. Credit two hours. Prerequisite course 305 (or 375). T Th 9. *Room* 377. Dr. GEORGIA.

Standardization, chemical properties, methods of application, and proper choice of disinfectants and other agents used in combating the spread of disease.

695. **Research for Seniors.** Throughout the year. See page 5. Dr. GEORGIA.

INDUSTRIAL CHEMISTRY

705. **Industrial Chemistry.** Lectures. Throughout the year. Credit three hours a term. Prerequisite course 405. M W F 10. *Room* 177. Professor RHODES.

A discussion of various typical processes of chemical manufacturing from the standpoint of: (a) available materials, their properties and limitations; (b) standard forms of apparatus used in chemical manufacturing; (c) properties and specifications of commercial chemicals; (d) computation of costs and profits in chemical manufacturing.

By special permission, candidates for the degree of Bachelor of Chemistry may be permitted to register for course 705 in their junior year and to postpone a part of their elective hours until the senior year.

710. **Industrial Chemistry.** Laboratory practice. Second term. Credit two, three, or four hours. Prerequisite course 405. Hours to be arranged. *Room* B-78. Professor RHODES, Dr. JOHNSON, and assistant.

The study in the laboratory, on a semi-plant scale, of processes and materials used in the chemical industries.

715. **Selected Topics in Industrial Chemistry.** Lectures. Second term. Credit one hour. Open to students who have completed or are taking course 705. F 11. *Room* 177. Professor RHODES.

A discussion of special topics in industrial chemistry. The lectures in 1925–26 will deal with the theory of fractional distillation and with the applications of fractional distillation to industrial processes.

720. **Bitumens.** Lectures. Second term. Credit two hours. Open to students who have completed or are taking course 705. M W 11. *Room* 177. Professor RHODES.

(Under the term "bitumen" as here used are included petroleum, native asphalts, and asphaltites, oil shales, and coal tar and other tars.)

The refining of petroleum; the manufacture of road tars, pitches, oils, and naphthas; the preparation of refined naphthas; tar acids; naphthalene, and other refined coal-tar products; the distillation of oil shales; and the preparation and utilization of asphalts and asphalt products.

725. **The Chemistry of Fuels.** Lectures. First term. Credit two hours. Open to students who have completed or are taking course 705. M W 11. *Room* 177. Professor RHODES.

The chemistry of coal, coke, and the fuel gases. Particular stress is laid upon the chemistry of the carbonization of coal and upon the applications of physical chemistry to the reactions involved in the manufacture and purification of the fuel gases.

730. **Chemical Plant Design.** Conferences and calculation periods. Repeated in the second term. Credit three hours. Prerequisite course 705. Hours to be arranged. Professor RHODES and Dr. JOHNSON.

Practice in the calculation and design of chemical plant equipment.

*775. **Engineering Chemistry.** Lectures. Repeated in the second term. Credit two hours. Prerequisite course 101. Not open to students who are candidates for the degree of Bachelor of Chemistry. May not be counted for upperclass group by candidates for the degree of Bachelor of Arts. M W 8. *Main Lecture Room.* Dr. JOHNSON.

Chemistry in its relations to engineering.

776. **Chemistry of Pulp and Paper.** Lectures. Second term. Credit two hours. Prerequisite course 775. Open to students in Forestry, to others only by special permission. T Th 10. *Room* 177. Dr. JOHNSON.

The chemistry of the manufacture of pulp and paper.

795. **Research for Seniors.** Throughout the year. See page 5. Professor RHODES and Dr. JOHNSON.

AGRICULTURAL CHEMISTRY

805. **Introductory Agricultural Chemistry (Fertilizers, Insecticides, Soils).** Lectures. First term. Credit two hours. Prerequisite course 305 (or 375). T Th 11. *Room* 107. Professor CAVANAUGH.

The relation of chemistry to agriculture and an introduction to the study of plant growth; the composition and chemical properties of soils, fertilizers, amendments, insecticides, and fungicides.

810. **Introductory Agricultural Chemistry.** Laboratory practice. First term. Credit two hours. Prerequisite courses 205 and 220 (or 210 and 225). Hours to be arranged. *Room* 350. Professor CAVANAUGH, Mr. MISCALL, and assistant.

Practice in the methods used by the chemist in the control laboratories of the factory, of the Government, and in the Experiment Stations, where fertilizers, insecticides, fungicides, and soils are examined.

815. **Introductory Agricultural Chemistry (Foods and Feeds).** Lectures. Second term. Credit two hours. Prerequisite course 305 (or 375). T Th 11. *Room* 107. Professor CAVANAUGH.

Discussion of the sources, chemical composition, and properties of the principal foods and feeds such as cereals, fruits, animal products, and dairy products. Relation of methods of preservation and manufacture to the nutritive value of foods.

820. **Introductory Agricultural Chemistry.** Laboratory practice. Second term. Credit two hours. Prerequisite courses 205 and 220 (or 210 and 225). Hours to be arranged. *Room* 350. Professor CAVANAUGH, Mr. MISCALL, and assistant.

The Methods of the Association of Official Agricultural Chemists are used in the examination and analysis of foods and feeding stuffs, such as milk and milk products, cereal products, canned vegetables, etc.

835. **Advanced Agricultural Chemistry (Fertilizers, Insecticides, Soils).** Laboratory practice. Either term. Credit two or more hours. Prerequisite course 810. Hours to be arranged. *Room* 350. Professor CAVANAUGH and Mr. MISCALL.

Advanced work in the chemistry of soils, fertilizers, plant composition, insecticides, or fungicides. Special topics may be selected.

840. **Advanced Agricultural Chemistry (Foods and Feeds).** Laboratory practice. Either term. Credit two or more hours. Prerequisite course 820. Hours to be arranged. *Room* 350. Professor CAVANAUGH and Mr. MISCALL.

Special topics in the chemistry of foods and food preparations.

*875. **Elementary Agricultural Chemistry.** Lectures. Second term. Credit three hours. May not be counted for upperclass group by candidates for the degree of Bachelor of Arts. Candidates for the degree of Bachelor of Chemistry may not receive credit for this course toward the degree. Prerequisite course 101. Lectures, M W F 12. *Room* 377. Professor CAVANAUGH.

The relation of chemistry to agriculture, and an introduction to the study of the composition and chemical properties of plants, fertilizers, feed stuffs, insecticides, and fungicides.

*880. **Elementary Chemistry of Food Products.** Lectures. Second term. Credit two hours. May not be counted for upperclass group by candidates for the degree of Bachelor of Arts. Candidates for the degree of Bachelor of Chemistry may not receive credit for this course toward the degree. Prerequisite course 101. W F 10. *Room* 377. Professor CAVANAUGH.

The chemical composition, physical and physiological properties, sources, and methods of manufacture of the principal food products.

895. **Research for Seniors.** Throughout the year. See page 5. Professor CAVANAUGH.

SEMINARY

905. **Seminary.** Credit one hour. M 5. *Room* 107. For seniors who are candidates for the degree of Bachelor of Chemistry.

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